

WHAT IS CLAIMED IS:

1. An arithmetic performance attribution method for determining portfolio performance, relative to a benchmark, over multiple time periods  $t$ , where  $t$  varies from 1 to  $T$ , comprising the steps of:

5        (a) determining coefficients  $c_1 = A$ , and  $c_2 = \left[ \frac{R - \bar{R} - A \sum_{jt} a_{jt}}{\sum_{jt} a_{jt}^2} \right]$ ,

where  $A$  has any predetermined value,  $a_{jt}$  is a component of active return, the summation over index  $j$  is a summation over all components  $a_{jt}$  for period  $t$ ,

$R = [\prod_{t=1}^T (1 + R_t)] - 1$ ,  $\bar{R} = [\prod_{t=1}^T (1 + \bar{R}_t)] - 1$ ,  $R_t$  is a portfolio return for period  $t$ ,  $\bar{R}_t$  is a

10      benchmark return for period  $t$ , and the components  $a_{jt}$  for each period  $t$  satisfy  $\sum_j a_{jt} = R_t - \bar{R}_t$ ; and

15      (b) determining the portfolio performance as  $R - \bar{R} = \sum_i [c_1 a_{it} + c_2 a_{it}^2]$ , where the summation over index  $i$  is a summation over all the terms  $(c_1 a_{it} + c_2 a_{it}^2)$  for period  $t$ .

2. The method of claim 1, wherein  $A$  is

$$A = \frac{1}{T} \left[ \frac{(R - \bar{R})}{(1 + R)^{1/T} - (1 + \bar{R})^{1/T}} \right], \text{ where } R \neq \bar{R},$$

or for the special case  $R = \bar{R}$  :

$$A = (1 + R)^{(T-1)/T}.$$

20      3. The method of claim 1, wherein  $A = 1$ .

4. An arithmetic performance attribution method for determining portfolio performance, relative to a benchmark, over multiple time periods  $t$ , where  $t$  varies from 1 to  $T$ , comprising the steps of:

25      (a) determining a set of coefficients  $c_k$ , including a coefficient  $c_k$  for each positive integer  $k$ ; and

(b) determining the portfolio performance as  $R - \bar{R} = \sum_{it} \sum_{k=1}^{\infty} c_k a_{it}^k$ , where  $a_{it}$  is a component of active return for period  $t$ , the summation over index  $i$  is a summation over all components  $a_{it}$  for period  $t$ ,  $R = [\prod_{t=1}^T (1 + R_t)] - 1$ ,  $\bar{R} = [\prod_{t=1}^T (1 + \bar{R}_t)] - 1$ ,  $R_t$  is a portfolio return for period  $t$ ,  $\bar{R}_t$  is a benchmark return for period  $t$ , and the components  $a_{it}$  for each period  $t$  satisfy  $\sum_i a_{it} = R_t - \bar{R}_t$ , where the summation over index  $i$  is a summation over all components  $a_{it}$  for said each period  $t$ .

5. The method of claim 4, wherein A is

$$A = \frac{1}{T} \left[ \frac{(R - \bar{R})}{(1 + R)^{1/T} - (1 + \bar{R})^{1/T}} \right], \text{ where } R \neq \bar{R},$$

10 or for the special case  $R = \bar{R}$ :

$$A = (1 + R)^{(T-1)/T}.$$

6. The method of claim 4, wherein  $c_k = 0$  for each integer  $k$  greater than two,

$$c_1 = A, \quad c_2 = \left[ \frac{R - \bar{R} - A \sum_{jt} a_{jt}}{\sum_{jt} a_{jt}^2} \right], \quad A \text{ has any predetermined value, the summation over}$$

15 index  $j$  is a summation over all components  $a_{jt}$  for period  $t$ ,  $R = [\prod_{t=1}^T (1 + R_t)] - 1$ ,  $\bar{R} = [\prod_{t=1}^T (1 + \bar{R}_t)] - 1$ ,  $R_t$  is a portfolio return for period  $t$ ,  $\bar{R}_t$  is a benchmark return for period  $t$ , and the components  $a_{jt}$  for each period  $t$  satisfy  $\sum_j a_{jt} = R_t - \bar{R}_t$ .

7. A computer system, comprising:

20 a processor programmed to perform an arithmetic performance attribution computation to determine portfolio performance, relative to a benchmark, over multiple time periods  $t$ , where  $t$  varies from 1 to  $T$ , by determining coefficients  $c_1 = A$ , and

$$c_2 = \left[ \frac{R - \bar{R} - A \sum_{jt} a_{jt}}{\sum_{jt} a_{jt}^2} \right],$$

where  $A$  has any predetermined value,  $a_{jt}$  is a component of active return, the summation over index  $j$  is a summation over all components  $a_{jt}$  for period  $t$ ,  $R$  is

5  $R = [\prod_{t=1}^T (1 + R_t)] - 1$ ,  $\bar{R}$  is  $\bar{R} = [\prod_{t=1}^T (1 + \bar{R}_t)] - 1$ ,

$R_t$  is a portfolio return for period  $t$ ,  $\bar{R}_t$  is a benchmark return for period  $t$ , and the components  $a_{jt}$  for each period  $t$  satisfy  $\sum_j a_{jt} = R_t - \bar{R}_t$ , and determining the portfolio performance as  $R - \bar{R} = \sum_{it} [c_1 a_{it} + c_2 a_{it}^2]$ , where the summation over index  $i$  is a summation over all the terms  $(c_1 a_{it} + c_2 a_{it}^2)$  for period  $t$ ; and

10 a display device coupled to the processor for displaying a result of the arithmetic performance attribution computation.

8. The computer system of claim 7, wherein  $A$  is

$$A = \frac{1}{T} \left[ \frac{(R - \bar{R})}{(1 + R)^{1/T} - (1 + \bar{R})^{1/T}} \right], \text{ where } R \neq \bar{R},$$

15 or for the special case  $R = \bar{R}$ :

$$A = (1 + R)^{(T-1)/T}.$$

9. A computer system, comprising:

a processor programmed to perform an arithmetic performance attribution computation to determine portfolio performance, relative to a benchmark, over multiple time periods  $t$ , where  $t$  varies from 1 to  $T$ , by determining a coefficient  $c_k$  for each integer  $k$  greater than zero, and determining the portfolio performance as  $R - \bar{R} = \sum_{it} \sum_{k=1}^{\infty} c_k a_{it}^k$ , where  $a_{it}$  is a component of active return for period  $t$ , the summation over index  $i$  is a summation over all components  $a_{it}$  for period  $t$ ,  $R = [\prod_{t=1}^T (1 + R_t)] - 1$ ,

$\bar{R} = [\prod_{t=1}^T (1 + \bar{R}_t)] - 1$ ,  $R_t$  is a portfolio return for period  $t$ ,  $\bar{R}_t$  is a benchmark return for

period  $t$ , and the components  $a_{it}$  for each period  $t$  satisfy  $\sum_i a_{it} = R_t - \bar{R}_t$ , where the

summation over index  $i$  is a summation over all components  $a_{it}$  for said each period  $t$ ;  
and

5 a display device coupled to the processor for displaying a result of the arithmetic performance attribution computation.

10. The computer system of claim 9, wherein  $c_k = 0$  for each integer  $k$  greater than

two,  $c_1 = A$ ,  $c_2 = \left[ \frac{R - \bar{R} - A \sum_{jt} a_{jt}}{\sum_{jt} a_{jt}^2} \right]$ ,  $A$  has any predetermined value, the summation

10 over index  $j$  is a summation over all components  $a_{jt}$  for period  $t$ ,  $R = [\prod_{t=1}^T (1 + R_t)] - 1$ ,

$\bar{R} = [\prod_{t=1}^T (1 + \bar{R}_t)] - 1$ ,  $R_t$  is a portfolio return for period  $t$ ,  $\bar{R}_t$  is a benchmark return for

period  $t$ , and the components  $a_{jt}$  for each period  $t$  satisfy  $\sum_j a_{jt} = R_t - \bar{R}_t$ .

11. A computer readable medium which stores code for programming a processor to

15 perform an arithmetic performance attribution computation to determine portfolio performance, relative to a benchmark, over multiple time periods  $t$ , where  $t$  varies from 1

to  $T$ , by determining coefficients  $c_1 = A$ , and  $c_2 = \left[ \frac{R - \bar{R} - A \sum_{jt} a_{jt}}{\sum_{jt} a_{jt}^2} \right]$ , where  $A$  has any

predetermined value,  $a_{jt}$  is a component of active return, the summation over index  $j$

is a summation over all components  $a_{jt}$  for period  $t$ ,  $R = [\prod_{t=1}^T (1 + R_t)] - 1$ ,

20  $\bar{R} = [\prod_{t=1}^T (1 + \bar{R}_t)] - 1$ ,  $R_t$  is a portfolio return for period  $t$ ,  $\bar{R}_t$  is a benchmark return for

period  $t$ , and the components  $a_{jt}$  for each period  $t$  satisfy  $\sum_j a_{jt} = R_t - \bar{R}_t$ , and

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determining the portfolio performance as  $R - \bar{R} = \sum_i [c_1 a_{it} + c_2 a_{it}^2]$ , where the summation over index  $i$  is a summation over all the terms  $(c_1 a_{it} + c_2 a_{it}^2)$  for period  $t$ .

12. The medium of claim 11, wherein A is

$$5 \quad A = \frac{1}{T} \left[ \frac{(R - \bar{R})}{(1 + R)^{1/T} - (1 + \bar{R})^{1/T}} \right], \text{ where } R \neq \bar{R},$$

or for the special case  $R = \bar{R}$ .

$$A = (1 + R)^{(T-1)/T}.$$

13. A computer readable medium which stores code for

10 program which stores code for programming a processor to perform an arithmetic performance attribution computation to determine portfolio performance, relative to a benchmark, over multiple time periods  $t$ , where  $t$  varies from 1 to  $T$ , by determining a coefficient  $c_k$  for each integer  $k$  greater than zero, and

determining the portfolio performance as  $R - \bar{R} = \sum_{it} \sum_{k=1}^{\infty} c_k a_{it}^k$ , where  $a_{it}$  is a component

of active return for period  $t$ , the summation over index  $i$  is a summation over all

15 components  $a_{it}$  for period  $t$ ,  $R = [\prod_{t=1}^T (1 + R_t)] - 1$ ,  $\bar{R} = [\prod_{t=1}^T (1 + \bar{R}_t)] - 1$ ,  $R_t$  is a

portfolio return for period  $t$ ,  $\bar{R}_t$  is a benchmark return for period  $t$ , and the components

$a_{it}$  for each period  $t$  satisfy  $\sum_i a_{it} = R_t - \bar{R}_t$ , where the summation over index  $i$  is a

summation over all components  $a_{it}$  for said each period  $t$

20 14. The medium of claim 13, wherein  $c_k = 0$  for each integer  $k$  greater than two.

$$c_1 = A, \quad c_2 = \left[ \frac{R - \bar{R} - A \sum_{jt} a_{jt}}{\sum_{jt} a_{jt}^2} \right], \quad A \text{ has any predetermined value, the summation over}$$

index  $j$  is a summation over components  $a_{jt}$  for period  $t$ ,  $R = [\prod_{t=1}^T (1 + R_t)] - 1$ ,

$$\bar{R} = \left[ \prod_{t=1}^T (1 + \bar{R}_t) \right] - 1, \quad \text{where } R_t \text{ is a portfolio return for period } t, \text{ and } \bar{R}_t \text{ is a benchmark return for period } t.$$

period  $t$ , and the components  $a_{jt}$  for each period  $t$  satisfy  $\sum_j a_{jt} = R_t - \bar{R}_t$  where the summation over index  $j$  is a summation over all the components  $a_{jt}$  for said each period  $t$ .

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"METHOD AND APPARATUS FOR DETERMINING THE POSITION OF A MOBILE STATION IN A CELLULAR COMMUNICATION SYSTEM"